

Abstract:

A fluid pumping system can be operated in dual control modes: as a syringe pump for nano-flow solvent delivery; and as a reciprocating pump for micro- and analytical flow solvent delivery. The fluid pumping system is also operated in a closed-loop digital control process using an optical encoder for piston refill stroke begin and end synchronization with a switching valve On and Off. A multidimensional apparatus and procedure using up to 8 of the invented fluid pumps for a fully automated procedure such as ICAT[™] chemistry for cellular protein separation, identification and quantification.